



T0087-S Validation of Electro-hydrodynamic Control of Two-phase Heat Transfer in Microgravity

Problem Statement

- Two-phase thermal systems are critical for future NASA's missions as they enhance heat transfer by two orders of magnitude.
- Flight experiments are needed for testing the EHD technology in microgravity.
- Potential applications of the mature EHD technology are in thermal systems of spacecrafts and aircrafts.

Technology Development Team

- Principal Investigator: Boris Khusid, New Jersey Institute of Technology, khusid@njit.edu.
- NASA provides funding support to this effort
- Advanced Cooling Technologies and Sandia National Labs may become partners in the development of EHD technology.

Proposed Flight Experiment

Experiment Readiness:

- The experiment will be ready for flight in the fourth quarter or 2014.

Test Vehicles:

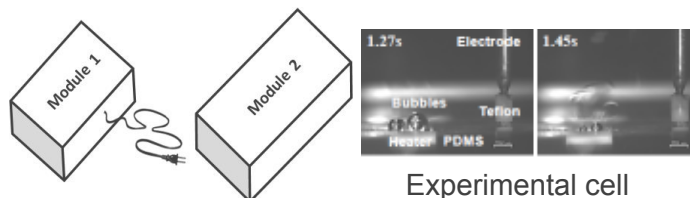
- sRLV's.

Test Environment:

- Parabolic flight tests (15 s of microgravity per parabola) are scheduled in July 2013.
- Tests with 3-4 min of micro-gravity ($0g \pm 0.3g$) are requested through Flight Opportunities Program.

Test Apparatus Description:

- The apparatus will consist of two modules (1, power supply, 20-40 W; 2, experimental cell, data acquisition) representing a miniaturized version of the system for parabolic flights.
- Test steps will be programmed in advance and run without an operator.



Technology Maturation

- Success of zero-gravity tests should advance EHD maturity from current TRL 3 to TRL 6.
- Steps and timeline to mature EHD technology:
- Miniaturization of high-voltage power system -1 year
- Optimization of voltage regime and electrode geometry- 2 year
- Successful long-term zero-gravity testing - 3 year.

Objective of Proposed Experiment

- Record boiling heat transfer and bubble dynamics in microgravity over a period of about 4 min.
- Flight data on boiling heat transfer and bubble behavior will be used for the development of high-voltage power system and electrode geometry.